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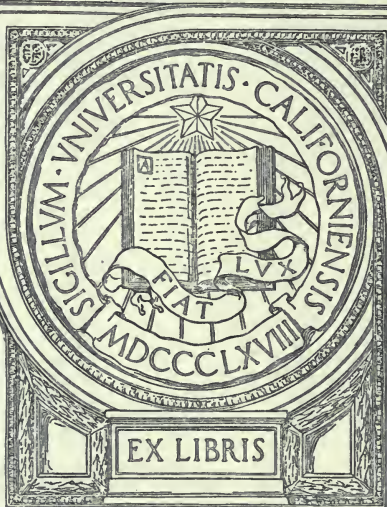
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# CARE AND MANAGEMENT OF ORCHARDS.

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BULLETIN No. 22.

*(Third Edition, re-revised.)*

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DEPARTMENT OF AGRICULTURE

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—OF—

BRITISH COLUMBIA.

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The following Bulletin on Care and Management of Orchards (being the third edition of No. 14, re-revised) is an addendum to Bulletin No. 12, Information for Fruit Growers, and is published by order of the Hon. R. G. Tatlow, Minister of Agriculture, for distribution amongst members of Farmers' Institutes and for general information.

J. R. ANDERSON,

*Deputy Minister of Agriculture.*

*Department of Agriculture,*

*Victoria, B. C., June, 1907.*

# CARE AND MANAGEMENT OF ORCHARDS.

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Bulletin No. 12 dealt principally with the preliminary work in starting commercial orchards, and I now propose to deal with the care and management of orchards after they are fairly under way. Before proceeding further, I will again refer to an unaccountable error which occurred on page 3 of Bulletin 12, where, in advising the selection of a site, I am made to say that western and southern exposures are not adapted for orchards; this should read eastern and southern. And further on a north-eastern exposure is recommended; this should read a north-western exposure. The context shows the intention, but the errors are nevertheless probably very perplexing.

## CULTIVATION.

Possibly the most potent factor in the success of an orchard is the proper cultivation of the soil, keeping it free of weeds and plant growth generally, and by this means having the surface in a perfect state of tilth and thus keeping the trees healthy and strong, so that they are better able to withstand the attacks of diseases and insect pests. It is an undeniable fact that new diseases are constantly finding their way into our orchards, in spite of the utmost vigilance of the Board of Horticulture, and the best way of resisting and eradicating these diseases is keeping the trees healthy; thorough cultivation is a better specific than any after-methods—prevention is always better than cure. As a matter of course, some soils naturally require more cultivation than others, but all soils should be kept in a state of cultivation, either by means of shallow ploughing, disc harrowing, or by use of the cultivator until the period of full maturity of fruit and foliage is attained, when cultivation may be discontinued until the following season. Referring to the subject of cultivation of the soil, L. H. Bailey says in Bulletin 19, Cornell University:—

“A finely divided, mellow, friable soil is more productive than a hard and lumpy one of the same chemical composition, because it holds and retains more moisture; holds more air; presents greater surface to the roots; promotes nitrification; hastens the decomposition of the mineral elements; has less variable extremes of temperature; allows a better root hold to the plant. In all these ways and others the mellowness of the soil renders the plant food more available, and affords a congenial and comfortable place in which the plant may grow.”

There is no harm—in fact, it might be done with profit—during the first few years in the life of an orchard to raise hoed crops between the trees, but as soon as the trees begin to send their roots any distance and the foliage shades the land, it is not advisable to continue the practice. Seeding down with clover and ploughing in, when the trees are several years old, is recommended for the purpose of adding humus and fertility to the soil. Grasses and grains are on no account permissible, and the practice so common in British Columbia to attempt to get crops of hay out of the same land which

is supposed to yield the owner good returns in fruit, is not only contrary to common sense, but opposed to every law of nature. It is most unreasonable to expect land to produce two crops at one and the same time. Either dig up your fruit trees and leave commercial orcharding alone, or plough up your grass and let the trees have the full benefit of the soil. More under-sized, poorly flavoured fruit is produced by attempting to make a hay field out of an orchard than probably any other means.

G. B. Brackett, United States Pomologist, says:—

“Thorough and oft-repeated stirring of the soil is absolutely essential to success. Such culture as is needed to produce a first-class crop of corn or potatoes will keep an orchard in good health and vigour, provided the ground is sufficiently fertile. As already stated, in no case should small grain or grass be grown in an orchard. This mistake is often made by thoughtless or inexperienced planters.

“The ground having been properly prepared before planting, a two-horse cultivator frequently run between the rows will keep it in good condition during growing season. Each spring the surface should be well stirred with a two-horse plough, using a short single-tree next to the row of trees to avoid danger of bruising the trunks of the trees. In ploughing, the furrows should be alternately turned toward and from the trees. Such culture should be continued from year to year, at least until trees come into full bearing, and even then it is questionable whether it should be discontinued. If it should be, red or crimson clover is the only crop allowable, and that should be turned under as often as once in every two years. As a rule, continuous cultivation gives the most satisfactory results.”

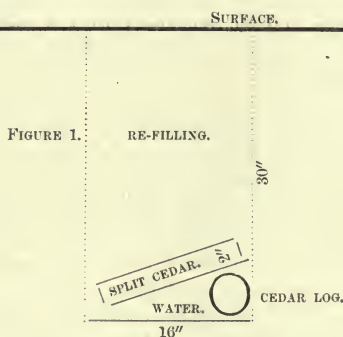
#### DRAINAGE.

Intimately connected with cultivation is the subject of drainage, for badly or imperfectly drained land cannot be successfully cultivated. To land with clay sub-soils this remark more particularly applies, as it is on such soils that water will lie longest on account of the retentive nature of the sub-soil. In such localities, as soon as the roots of the trees have penetrated to the clay, there is a suspension of growth, with a consequent deterioration in the health of the tree, rendering it susceptible to the attacks of insect pests, fungous diseases and parasites in the shape of lichens and mosses. As a rule, the appearance of mosses and lichens is a pretty sure indication of an undrained state of the land, and whilst the application of washes of different kinds are useful for the removal of the effect, the true remedy lies in the removal of the cause. Therefore, if draining has been neglected, no time should be lost in immediately proceeding to remedy the defect by a thorough system of surface and under-draining. No orchard can survive any length of time where stagnant water lies, either on the surface or in the soil, and, therefore, all surplus water, either from excessive precipitation or any other cause, should not be allowed to remain on the land. By draining the surplus water from the soil the air is allowed to circulate through the soil. This has the effect of rendering the soil warmer and decomposing those elements of fertility in it which otherwise would remain unavailable as plant food. Well drained land is also less susceptible to drought than land where surplus water lies.

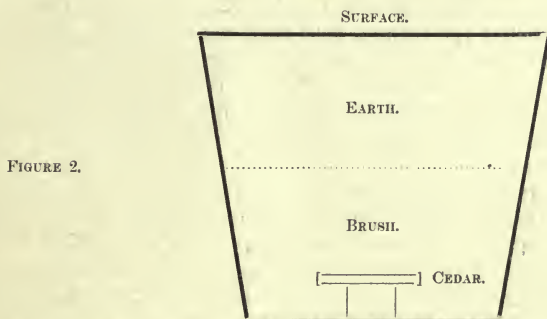
Instances corroborative of this fact are too constantly seen on the roadsides in summer, where places which have had water lying until late in the spring are the first to dry up and crack when the heat of summer comes on.

Without doubt, tile draining is the best and most durable, whilst other methods may be cheaper in this country—for instance, the use of split cedar and, where they are available, filling the drains with stones. Cedar may be used as follows, which is recommended by H. T. Thrift, of Hazelmere. He says:—

“The cheapest plan I know of is to dig the drain 16 inches wide and say 2 feet 6 inches deep; lay straight cedar rails, which are easily obtained in the woods, along one side of the ditch, and lay boards 1 to 1½ inches thick and 16 inches long, one end resting on the rails and the other in the angle of the ditch. If the boards are laid in carefully, this makes an excellent drain and will last for many years, and costs complete, if the work is well done, about 40 cents per rod. (See Fig. 1.)



Another plan which is frequently followed is to dig the drain to the required depth, then take out from the centre of the bottom a channel about 6 inches wide and 6 inches deep. Over this lay split cedar crosswise or lengthwise, and fill in with brush and then with earth, as shown in Fig. 2.



Underdrains should not be less than 2 feet 6 inches in the soils requiring draining least and certainly deeper in stiff clay soils, say 3 feet 6 inches. The deeper drains are more effective, and in the long run less expensive, as

they do not need to be so close together. Moreover, the deeper drains are less liable to leach out the soil of its fertility in the shape of its more valuable components. In draining, the nature of the soil, the lay of the land and any other conditions have to be taken into consideration in laying out the drains, including their frequency and direction.

#### FERTILISERS.

Barnyard manure is far and away the best all-round fertiliser for any kind of soil. Not only is it as near a perfect fertiliser as can be obtained naturally, but the fact that it is the means of placing humus in the soil, which is being constantly exhausted, alone places it in the front rank of fertilisers. I am an advocate of placing it on the land fresh day by day, provided the conditions are such that the most valuable constituents of the manure will not be leached out of the soil. If this is impracticable, then the best plan is to place the manure under cover, spreading it out so that it will not heat, and allow calves or other stock to run on it. By those means the rain will not leach it out, and by spreading over a larger surface it does not heat and so deteriorate in quality; moreover, such a shed forms an excellent open-air space for stock. Other authorities advise well-rotted manure as being the best form to apply it to the land for an apple orchard. From all points, which I do not think it necessary to enter into here, I have faith from personal experience in the application of manure fresh from the stable. In any case, whatever plan is adopted the greatest care should be taken to prevent the manure from leaching out and from heating, either being fatal to its highest usefulness. Unleached wood ash is another most valuable fertiliser for fruit trees. Unfortunately, however, in British Columbia the proportion of conifers is so much in excess of other woods that good wood ash is not obtainable in any quantity, coniferous woods making but little ash, and that of an inferior quality. All wood ashes are, however, valuable, and should be carefully preserved from rain and applied in an unleached state to the surface of the ground near fruit trees. A word here of warning as to the placing of fertilisers about trees. I have frequently noticed that manures are heaped about the trunks of trees. A little consideration will show the fallacy of this method. Such a practice really does more harm than good, inasmuch as it affords shelter for vermin, field mice, voles, gophers, etc., which destroy the bark of the trees, but the fertilising elements contained in the manure are wasted, as they are leached out into the soil and never reach the feeding portions of the roots. What is meant by the feeding parts of the roots are the small fibres which extend a long way from the trunk. These fibres, even in small, two-year-old trees, may extend two feet from the trunk, and it can be therefore easily imagined that in a five-year-old tree the distance may be anywhere from ten to twelve feet. It follows, therefore, that a clear space of several feet should be allowed all round the trunk of the tree.

Commercial or artificial fertilisers, so-called, are useful for replacing the lost or wanting elements of fertility in the soil, but it must be understood that they do not supply humus, without which the soil soon becomes hard and lumpy. Therefore, in conjunction with artificial fertilisers, it is important that something should be done to put humus into the soil, and for this purpose no better method can be advised than the seeding down with

common red clover and turning it in the second year. Clover not only supplies the needed humus, but has the effect of introducing nitrogen into the soil from the air, and since nitrogenous forms of fertilisers are the most expensive, it is so much saved to the orchardist. The best plan is to buy commercial fertilisers separately, that is, not a mixed fertiliser, as the farmer can then apply them in the proportions he wishes. It is, of course, difficult, perhaps impossible, to say what constituents the soil is deficient in; but ordinarily, a fertiliser containing one and one-half to two per cent. of nitrogen, seven to nine per cent. of available phosphoric acid, ten to twelve per cent. of potash, will give excellent results when applied to orchard land in quantity ranging from 400 to 600 pounds per acre, but if a crop of clover has been turned in the nitrogen can be omitted. Prof. Shutt, in a lecture at the annual meeting of the Nova Scotia Fruit Growers' Association, in February, 1899, thus describes the functions of the three principal elements of plant food, nitrogen, phosphoric acid and potash, viz. :—

“Nitrogen is an essential for plant life. Its function, more particularly, is to promote leaf growth. Leaves are very necessary to the well-being of the tree, as they serve the purpose of both mouth and stomach. The fruit also contains a certain amount of nitrogen. It is chiefly, however, for the development of the leaf, without which a good crop of well-formed apples is not obtainable. Trees, in common with all plants, take their nitrogen from the soil in the form of nitrates—compounds formed by various influences and under certain conditions from the nitrogenous organic (vegetable) matter in the soil. The process is known as nitrification, and is brought about by the agency of minute organisms (always present in the soil) when the soil is in good tilth, warm and moist.

“Phosphoric acid is contained in the mineral part (ash) of the woody tissue in wood and leaves, as well as in the fruits and seeds. It is not only necessary for growth, but seems to have a special value in the maturation or ripening both of the wood and fruit.

“Potash: This, of all the mineral constituents, is the most important for fruit trees, both large and small. The well-being of the tree largely depends upon an abundant supply of soil potash in an available condition. It forms by far the greater portion of the ‘ash’ of the wood and leaves, and approximately one-half of that of the fruit.”

Lime is not a fertiliser in the strict sense of the term, its functions being chiefly in the liberating of plant food, which is already in the soil but in unavailable forms, and also in the improvement of the conditions of clay and hard, refractory soils. Prof. Shutt says of it:—

“Lime is not so necessary for apple and pear trees as it is for the stone fruits, but it is, nevertheless, a valuable constituent for the orchard soil, for trees grown upon limestone soil are found to be sturdy, strong stock and to have a vigorous growth. Lime acts in two ways, mechanically and chemically. It serves directly in furnishing nourishment for the growth of the tree; it serves indirectly in the liberation of locked-up plant food, more especially of the potash. It does most useful work in improving the texture of both heavy clay and light soils. It is usually, however, on the former that it is especially needed.”

The quantity and frequency that lime should be applied depends greatly upon the conditions of the land. As a general rule, it may be stated that from half a ton to one and a half tons per acre, applied say every five or six years, is sufficient.

No prescription can be written for feeding all fruit trees, as there are so many varying conditions. The feeding of plants is not unlike the feeding of animals. We do not feed horses and swine on the same diet; each is known to do best under its own particular treatment. A good florist understands his plants and knows their wants; a good fruit-grower needs a similar knowledge of the plants he is to depend upon for success.

The New Hampshire College Experimental Station has a bulletin in press written by the Horticulturist, Prof. F. Wm. Rane, in which he discusses the subject. The kind and amount of fertiliser for each kind of fruit is given and the subject discussed.

*Apples*.—For nitrogen: (1) 50 to 100 lbs. nitrate of soda; or (2) 40 to 80 lbs. sulphate of ammonia; or (3) 80 to 160 lbs. dried blood.

For phosphoric acid: (1) 300 to 600 lbs. bone meal; or (2) 200 to 400 lbs. dissolved bone black; or (3) 250 to 500 lbs. dissolved rock.

For potash: (1) 100 to 200 lbs. muriate; or (2) 100 to 200 lbs. sulphate; or (3) 400 to 800 lbs. kainit; or (4) 1,000 to 2,000 lbs. wood ashes.

Too much nitrogen is to be avoided, as the tendency will be to run to growth rather than to fruit. The potash may be applied in the fall; also one-half the phosphoric acid; but the remainder should be applied in the spring. Potash is generally considered the most important constituent, since fruits withdraw much larger quantities of it than of the nitrogen or phosphoric acid.

### MULCHING

Is useful during hot, dry summers, when natural moisture is short, to protect the soil over the roots of trees from the scorching effects of the sun, and sometimes, when there is a sufficiency of frost, to confine it in the ground so as to retard the rising of the sap. Mulching, however, should be done judiciously, and, as in manuring, it should not be placed in proximity to the trunk, and it should be done lightly, so as not to induce the roots to come too near the surface, and the mulch should, after it has decayed, be dug into the soil. Almost any rubbish does for mulching, such as weeds of all kinds, provided they are not in seed, ferns, old straw, etc. I have used chips from the wood-yard successfully; these, of course, cannot be dug in. Sawdust of coniferous woods should not be used; on account, I presume, of the acrid principle they contain, the sawdust of such wood seems to have a deleterious effect on land.

### PRUNING.

Continuing my remarks under this head in Bulletin No. 12, where, I endeavoured to give some advice as to the method of starting a tree in life by judicious pruning at the outset, and so training the tree in the desired shape, I will now try to show how the important subject of pruning should be conducted in after life, so as not only to keep the tree with a well-balanced head, but at the same time to induce the greatest fruitfulness. Injudicious pruning

is often the cause of much after trouble, in bringing back the tree to its proper shape. Cutting off large limbs during the winter season and excessive pruning has the effect of making a broom-like head, by inducing a number of small branches to grow out, rendering the head of the tree impervious to sun and air. As a rule, summer pruning, which is done principally by pinching the growing buds, promotes fruit bearing, whereas winter pruning promotes wood growth. Nevertheless, winter is the season when superfluous branches have to be removed and the excessive growth of the previous season cut back to the required bounds. In removing large limbs, they should be sawed off as near the trunk as possible, beginning on the lower side to prevent splitting, after which the wound should be smoothed with a sharp knife and covered with grafting wax or painted with some of the preparations recommended in Bulletin No. 12. In cutting back the growth of the previous year, the cut should be made close to a bud, generally an outer one, the cut being slightly diagonal but nearly horizontal, so as to offer as little surface as possible exposed. Always use a sharp knife, which should be kept exclusively for the purpose. M. B. Curtis, Yakima, in a paper read before the Washington Horticultural Society at Seattle, says, regarding pruning:—

“The first year after setting, head the shoots back from eight to twelve inches, according to the vigour of the growth, those least vigorous to be shortened in the most. Exercise the same care in reference to the terminal bud and manner of cut as before. Care and judgment must be exercised in selecting the position of the bud. If straight shoots are desired, cut to inside buds for trees of a spreading character like the Greening; or for compact growers like the Northern Spy, cut to outside buds. It is best to cut outside buds on the side next the wind, in order to throw the growth toward the wind, and sometimes on the opposite side of the same tree it will be necessary to cut inside buds to maintain an evenly balanced top.

“The second year from planting the previous season's growth should be headed back to about twenty inches, the less vigorous growth to be pruned the most. Keep the length of the cut as nearly even as possible, varying, of course, to suit the buds that come in the desired position.

“Remove all cross branches and those having a tendency to grow towards the centre of the tree, except the fruit spurs. These should not be removed, even from the first year's growth. The fruit spurs are thrown out straight from the trees and look like thorns or growth on seedlings. The mistake is often made of removing these, and, in consequence, leaving long, bare poles.

“The third year from planting, shorten back to from two to three feet of previous year's growth. This pruning applies to apples, pears and the plum family. Cherry trees should be dropped from the list the first, and the method of pruning them will not be handled in this paper.

“This is the last of the shortening in on these varieties. With this, the fourth season's growth, the head will be formed, if all has gone well, and with the exception of an occasional refractory branch, which should be shortened in, will not need to be touched.

“The tree is now ready for fruiting. Commencing in June, pinch prune, removing all superfluous growth, and keep the head symmetrical. This

pruning in during June will have a tendency to throw the tree into fruiting. Keep off all straggling branches that have a tendency to grow toward the ground. The tree is now in shape; pinching in will keep it there. Ingrowing branches can be nipped in the bud.

"Peaches and apricots should be treated from the start as the apple and plum family, but should be shortened in about half the season's growth each year. The shortening in process should not be done indiscriminately; they should be cut back to a good bud or fork, or else the tree will soon thicken up with an undesirable growth.

"There may be some fears that a crotch will be formed that will split down easily. This is not true, however. Branches starting out lower down are apt to form a sharp crotch and do not make a good union with the main stem; these will split down. 'Eternal vigilance is the price of liberty,' and also of a beautiful and symmetrical orchard."

The following is by Mr. George Quinn, Horticultural Instructor, South Australia:—

"Those kinds of trees which fruit upon permanent spurs are rendered more profitable by consistent manipulation during the growing season. Everyone who has tried by hard winter pruning to give trees of these kinds strong, shapely sets of main arms will have been confronted with the difficulty of dealing with an immense number of strong lateral shoots which grow with 'broomlike' density. To suppress these shoots completely would leave those portions of the main branches from which they originate bare and unproductive in future years, as well as exposed to the danger of sun scald in summer. To shorten them back towards the parent branch in winter would accentuate the evil, by causing their numbers to be multiplied during the following season of growth. By leaving them untouched, the light is shut out of the body of the tree, and the lower buds at the base of each lateral remain undeveloped. At the same time, those near its point tend to form into fruit buds, the produce of which bends the laterals into a confused mass, and spoils the general balance of the tree's crown.

"The correction of this overcrowded condition is found in subduing the laterals and transforming them into fruit-bearing spurs. There are two methods by which this may be done. The first consists of completely fracturing the laterals and removing the several portions. The second is found in applying a check in the form of partially fracturing the shoot and permitting the injured extremity to hang in a pendulous position until the winter pruning is performed, when, having served its purpose, it is removed.

"The first method may be applied in spring, when the laterals are from six to eight inches in length, and brittle enough to be severed with the thumb and finger. They are usually pinched off above the fourth bud from the base. If this is done, a strong growth will arise again from some of the buds on the stub, and these in turn must be fractured after midsummer. A more practicable method is found in fracturing the laterals at midsummer, wherever they exceed four inches in length. In most cases the topmost bud on the stub alone will grow strongly as the summer proceeds, and this may either be again fractured in early autumn or cut back to its wrinkled base

at the winter pruning. One or more of the other buds on the stub will, in the meantime, develop into short spurs, each carrying a rosette of leaves. Where there is much moisture in the soil and liberal cultivation is practised, the former plan will give good results, but in positions where moisture is failing and cultivation lax, the second fracturing will seldom be necessary. While this is being practised upon the laterals one of the shoots has been selected on each main branch as a leader which shall continue the extension and shape of the tree. This leading shoot is not pruned during the period when vegetation is in progress, but is dealt with in winter only. It is then pruned to a length which is regulated by its stability and direction of growth.

"Closer observation and knowledge of the locality are needed in connection with the successful application of the partial fracture. To obtain the best results, this must be performed at the time when the sap is receding. The buds upon the stubs will then form the short spurs with rosettes of leaves, to which we have already alluded as the growth to be desired. If, however, it is performed too early in the autumn the top bud on the stub usually grows strongly, while the others remain dormant. If, on the other hand, the partial fracture be applied too late in the autumn, all of the buds upon the stub remain quiescent, and with the return of the warmth of spring these will grow as vigorously as those upon laterals pruned only in winter, producing a great density of shade which the hanging shoots cast over the buds and spurs below. This is a very serious defect. The certainty with which buds upon the stubs of the completely fractured laterals start into growth also gives that method considerable preference, while the simplicity of the work does not call for skilled labour, close observation, or any previous knowledge of climatic conditions which prevail in the locality.

"In practice the complete fracturing is best done with a pair of blunt or loosely adjusted pruning shears, because the bruised sections made by such an instrument heal slowly and appear to restrain the energies of the sap upon the buds retained on the stub. The leaves on the stub should be carefully retained as far as possible.

"The partial fracture is quickly performed by pressing the lateral sideways over the blade of a pruning knife, which is also best suited to the work when slightly dull-edged. The half-severed portion then hangs alive and capable of using a certain amount of surplus sap if the operation happens to be done a little too soon.

"A word of warning is necessary in connection with the adoption of this practice. With the exception of those laterals which tend to crowd into the centre or between the main branches of the tree, these weakening operations should not be applied to young trees of average growth until about the third season after planting. If a few outside laterals are permitted to grow they will help the tree to thoroughly establish itself. At a later period such shoots may be shortened back gradually towards their parent branches. In the second place, with the exception of occasionally pinching out the growing tip of a strong leader or side shoot arising from the main stem, for the purpose of balancing the crown of the tree, no pruning should be applied during the season of active growth to any tree which lacks in vigour."

As to the heading of trees, Professor E. R. Lake, Horticulturist of the Oregon Experimental Station, Corvallis, expresses himself as follows:—

"A tree," he says, "should not be over a year old when planted in an orchard; it will then have a number of buds all along the stem. One of these, about nine inches from the ground, should be selected and allowed to grow; about nine inches above, and about a third of the way round the stem, allow the next to grow, and so on, always keeping a leader and allowing branches to grow not less than nine inches apart. The tree will at first present a rather awkward appearance, but it soon gets over that, for as the limbs grow out it assumes a symmetrical appearance."

The following cuts and explanatory remarks are furnished by Professor Lake:—

"I am sending you a drawing from nature of a one-year-old tree (Fig. 1) as we prefer it for usual plantings; Fig. 2, as the tree appears at the end of a year after transplanting; and Fig 3 as it is pruned for the formation of the permanent head.

"Some advantage could have been gained in growth had all the other branches been pinched back during the first season out, rather than permitting them to grow and then at the end of the season cutting out all except the ones left to form the head. A and B of Fig. 3 represent the places where branches will issue from the leader next year, and so on."

The pruning must, of course, be regulated by circumstances, the peculiarities of the variety and other conditions being taken into consideration. Above all things, Mr. Lake says, avoid cutting out the leaders; there is no part of the question of pruning that is so pernicious as the too common practice of cutting out the centre, thus forcing the tree to grow in an unnatural manner and inducing the formation of forks. A tree grown in this manner will, when it comes into bearing or from the effects of storms, be almost certain to split asunder at the fork and be ruined. The objects of low heading, as recommended, are two-fold, viz., to avoid, in a great measure, the full effects of storms, and the ease with which the fruit can be picked. No ladders being necessary, girls are able to gather the fruit from the ground, thus avoiding the injury to trees from the use of ladders and the rough usage fruit is subjected to through being handled in that way. Furthermore, he says, experience has proved that girls make better pickers than men—they handle the fruit with more delicacy and care, thus preventing a large percentage of bruised fruit. When asked how cultivation could be done in an orchard with low-heading trees, he said that by the use of spreaders, disc harrows and acme harrows or scarifiers could be made to till the soil beneath the trees, and yet permit the horses to travel safely away from them, even though the tops are broad and low. With low heads, well trained, cultivation can be done as thoroughly as when the trees are headed high. On all grounds, therefore, Mr. Lake contends that experience has proved that the system he recommends is by far the most practical, and gives better results in every way. I must acknowledge, after having heard Mr. Lake explain his views and his reasons, I feel that my ideas regarding high pruning should in a great measure be modified, and I, therefore, take great pleasure in adding this chapter to my former remarks in Bulletin No. 12.

From recent experiences in those parts of the Province where the snow-fall is heavy, it has been found that when a thaw sets in the lower branches are borne down by the weight of snow, and sometimes break down or are injured. In such cases the advice given above should be modified to suit the peculiar conditions. Either start the first branch higher up or resort to supports for the protection of the lower limbs.

#### IRRIGATION

Is treated of in Bulletin No. 12, as follows:—

The importance of applying moisture artificially in those parts of the country where the precipitation is insufficient cannot be over-estimated. Albeit there is as great danger attending an over-supply of water as there is of an insufficiency. Water should never be applied after the fruit has attained its full size, or there will be danger of injury to the fruit, impairing its keeping qualities so materially as to render it unfit for transportation. Another evil effect of irrigation after the wood has attained its maturity is the promoting of a second growth, so that the wood is in an unripe state when the winter comes on, often causing serious injury, or even the death of the tree; or in case of an early snow-storm, the tree not having shed its leaves, the breaking down of the limbs, or splitting the tree. As a matter of fact, a very small quantity of water, judiciously applied, *succeeded by cultivation*, is far better than an over-supply—beware of using too much water; cultivation is often all that is necessary, and when water is applied, use it intelligently.

This is what Mr. F. H. Newell, Hydraulic Engineer and Chief of the Division of Hydrography of the United States Geological Survey Department, says in "Irrigation in the United States," published in February:—

"In the humid regions rainfall is usually from 3 to 4 inches per month during the crop season. In the arid region, where the sunlight is more continuous and the evaporation greater, there should be, for the ordinary crops at least, enough water during the growing season to cover the ground from 4 to 6 inches in depth each month. Carefully tilled orchards have been maintained on far less. In Arizona, where the crop season is longest, being practically continuous throughout the year, twice as much water is needed as in Montana, where the crop season is short and the evaporation is less."

I do not know that there is much more to be added, except to reiterate the advice there given as to the danger of the excessive and needless use of water. Those people in the dry belt who have been fortunate enough to record water-rights securing them an ample supply, should not, for that reason, use more on their orchards than actual necessity demands. More harm has resulted from an excessive use of water than from an insufficiency. Careful cultivation and tillage go a long way towards the conservation of moisture in the soil.

Recent experiments in the United States have resulted in demonstrating that winter irrigation answers all purposes, and for many reasons is considered preferable to summer irrigation. One of the reasons adduced is that by following this course the natural addition of moisture to the soil is imitated. Another reason in favour of the method is the fact that water

can be utilised at that season of the year when it is most abundant, and most of it running to waste. It is claimed that by thoroughly saturating the soil with water in winter, it can be conserved for use during the growing season, keeping a dust mulch on the surface of the ground by means of the cultivation of the soil previously described.

#### THINNING.

This is a most important proceeding if No. 1 merchantable fruit is wanted. Generally speaking, no two fruits should touch one another. This is, of course, all but impossible in the matter of cherries, and in a minor degree with plums, but apples, pears and peaches should be thinned most rigorously. Apples should not be less than 4 to 6 inches apart. It will appear to the beginner when he relentlessly plucks and destroys fruit of good promise, that he is losing most of his crop. This idea can be dismissed without hesitation; the probability is that, with severe thinning, he will have as large a quantity in weight as if he had left the whole crop to come to maturity, with this difference, that in the former case he would have a crop consisting of a majority of No. 1 fruit, whilst in the latter case, the probability is that only a very small percentage would pass as No. 1, and the remainder would consist of No. 2, and a large proportion of an inferior grade.

#### DISEASES AND PESTS.

Insect pests and fungous diseases of every description await the orchardist at every turn; few are of native origin, the majority being the product of other countries, introduced on fruit, shrubs, trees, seeds and other means. As a rule, there is a compensating law of nature by which all insects injuriously affecting plant or animal life are kept in check by some antidote in the shape of enemies such as parasites and diseases, which, by preying upon their particular hosts, keep them within bounds. Now it so happens that in most cases, probably all cases, the antidote is not introduced with the pest, and therefore the increase of fruit pests in a country where importations of nursery stock, fruit, etc., are of daily occurrence is abnormally great, as compared with their native habitat. Recognising this fact, the authorities in the Old Country and the United States have gone to great trouble and heavy expense in ascertaining the particular enemies of imported pests, and under the direction of advanced entomologists and others have introduced the enemy, so that the ravages are greatly reduced. Nevertheless, in spite of natural enemies, the orchardist, if he seeks to attain success, must supplement these natural enemies by artificial means. In this country, where formerly fruit pests were practically unknown, it has been a difficult matter to induce the old producers to adopt means for the cleansing of their fruit trees, and the consequence is that many orchards have been either abandoned or destroyed. About the same conditions prevailed in Washington and Oregon, where Professor C. V. Piper, Entomologist of the Pullman Experimental College, states in Bulletin No. 153, as follows:—

“Along with the rapid development of the industry there has been a much more rapid increase in the damage caused by insects and diseases. Ten years ago there was little or no need to fight orchard pests, as the injury

caused by them was scarcely appreciable. At the present time, at least in the older sections, the fruit grower is compelled to combat insects or fungi, or both, in order to grow marketable crops.

"This marked change, coming in so short a time and in many cases involving serious loss, has naturally had a discouraging effect. In a few instances this discouragement has even led to the digging up of orchards. The increase in the amount of damage by orchard enemies has been the more depressing because the idea had gained considerable credence that the previous immunity from such loss was due to some special peculiarity of the soil or climate, or both. Unfortunately, this idea still prevails in sections where, for some reason or other, pests have not yet become a serious factor. At one time, when Western Oregon apples were justly famous, the growers said, 'We will never have wormy apples here because the climate is so moist.' In the warm interior valleys orchardists now claim that fungous diseases will never be a menace because the climate is too hot and dry; and upon the interior uplands their competitors say that no insect or fungus enemy need ever be feared because of the winds and the cool nights. In all this there is a somewhat laboured effort to consider 'as proven what is at best a hope. The experience of nearly every new region has been much the same. No place has yet been discovered where orchards will thrive where pests will not thrive also. The general truth of the statement is not affected by the well-known fact that the amount of damage caused by a particular insect or fungus varies greatly in different regions and in the same regions from year to year.

"The rapid spread of certain pests like the codlin moth and apple scab in recent years has led some to the opposite extreme of view, namely, that pests are far more injurious here than in other fruit-growing regions. A careful comparison of the loss occasioned here in neglected orchards with similar injury in older States reveals no evidence to justify such a conclusion.

"Many orchardists have been slow to adapt themselves to the new conditions caused by the introduction and spread of insects and fungous diseases. Although these new conditions have undoubtedly increased the cost of producing fruit, the growers who have used proper efforts to control insects and diseases have been uniformly successful in raising profitable crops of high-grade fruits; on the contrary, the product of neglected orchards is, as a rule, so badly injured that most of it is unmarketable, or must be sold at a very low price.

"Serving as object lessons, such results are doing much to increase rational efforts to combat orchard enemies, and, undoubtedly, the situation will become better from year to year, as the great majority of persons now setting out orchards realise beforehand that it is one of the factors necessary to success."

Owing to the determined attitude of the Board of Horticulture, we in this Province have so far happily escaped the San Jose scale, codlin moth, peach tree borer, and possibly some minor evils, the two former especially being amongst the worst enemies of the fruit-grower in the adjoining States

and Ontario; and it is hoped that with the vigilance of Mr. Thos. Cunningham, the efficient Inspector, and other officers of the Board, our present immunity may continue.

It is, of course, not the intention here to enter into details regarding insect pests and plant diseases, nor to describe the different means that are recommended for the mitigation of the evils; neither time nor space admit of it. All such information is obtainable from other publications issued by the Department and from the officers of the Board of Horticulture. Chief amongst the means recommended is the use of sprays of different kinds, the efficiency depending upon their purity and intelligent use. The desiderata are: (1st.) A good, well-equipped spray pump, one that is capable of throwing a strong stream, the capacity being, of course, dependant upon the extent of the orchard and the amount of work required to be done. (2nd.) A first-class nozzle, one that will not clog easily and that is capable of transforming the stream from the pump into a fine, fog-like spray; the finer the spray the more effective will be the work. Every part of a tree should be covered, but spraying should be discontinued as soon as there are signs of dripping. Rainy weather is unfavourable for spraying operations. (3rd.) The very best of made sprays or chemicals should be used, and a rigid observance of the rules laid down for making sprays and their use are absolutely imperative if success is to be attained. Clean and well-cultivated land, and so keeping, the trees healthy and vigorous, the burning of all rubbish lying about in orchards, the destruction of all infected fruit by fire in case of stone fruits infected with rot, and by feeding to farm animals when infected with insect pests, by painting the trunks of trees with the preparations recommended, and generally observing the rules laid down for keeping orchards free of disease and pests, are all conducive to success.

The following remedy for oyster shell bark louse, by W. T. Macoun, Horticulturist, Central Experimental Farm, Ottawa, not having been published before in any bulletin of this Department, and being of so simple a nature, I deem it best to give it publicity:—

“It has been only within the last ten years or so that spraying has been regarded as an important part of successful fruit culture. Recognising the value of anything that would prevent injury to trees and fruit, spraying has received considerable attention at the Central Experimental Farm, and many fungicides and insecticides have been tested to prove their relative merits. While experimenting with a lime mixture sprayed on fruit trees to prevent the swelling of the buds in early spring, Mr. W. T. Macoun discovered that the trees thus treated were practically rid of the oyster shell bark louse, an insect which does a great deal of injury to apple trees in the colder parts of Ontario and the Province of Quebec. The lime destroys the gelatinous mater which binds the scales to the tree, and the scales are then removed by the action of rain, frost or wind.

“In order to be most effective the spraying should be done in the autumn, and there should be two applications, so that all the scales may be covered. Lime used in the proportion of two pounds to one gallon of water has been found to be the best formula so far, but it is possible that one pound of lime to a gallon will be sufficient if the lime be good. This new





Figure 1.



Figure 2.

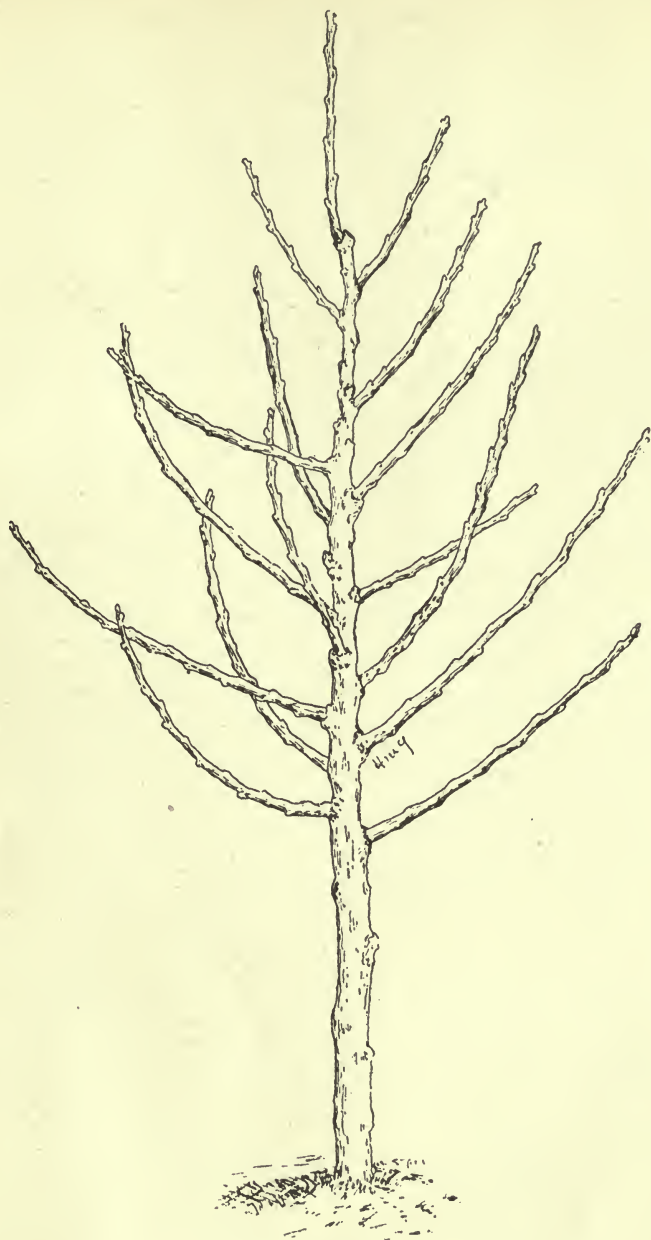


Figure 3.



remedy for the oyster shell bark louse is simple, cheap and very effective, and should prove a popular one. There is, in fact, no known remedy so good, economical and unfailing as this for the oyster shell bark louse.

"Kerosine emulsion has been usually used for this purpose, and with good success when the insects are running, but as they only run four or five days in the first week in June it is difficult to kill them all off in this way. By covering the trees with lime you are able to get at the scale, and the lime makes the trees white, so that you can see whether all the scales have been covered or not."

#### RENOVATING OLD ORCHARDS.

As a rule, if an orchard has been neglected for a number of years, the trees are so infected with insect pests and diseases and are so unhealthy that I would advise in most cases that they be rooted out and burned and replaced with young, vigorous stock. There are many such instances of neglect in the older portions of this Province, where I do not hesitate to give the advice. If, however, it is considered best to attempt the renovation of an orchard of this description, I commend the following recommendations by Mr. W. T. Macoun, who, in speaking of old neglected orchards, says:—

"On the other hand, there are many orchards where the trees, if cared for, would be in the prime of life, and neglect is the only cause which prevents profitable crops from being grown. It is of orchards such as these that a few suggestions are here offered as to how to bring them back into good condition; but the results desired cannot be got in one year.

"The trees, to begin with, should be pruned, not too heavily at first, but enough limbs should be taken out to open up the top and permit a free circulation of air and the admission of sunlight to it. The trees will probably be much moss grown, and both they and the fruit may be affected with various diseases. Injurious insects, too, are almost certain to abound.

"Spraying should be begun early in the season, and the trees should be kept covered from top to bottom with Bordeaux mixture and Paris green, until the fruit is almost fully grown. Scraping the trunks and large branches of the trees may be done if there is much moss, but as soon as the tree becomes more vigorous and air and sunshine are admitted, much of the moss will disappear. If the oyster shell bark louse or other scale insects infest the trees, they should be sprayed with the lime mixture, or other material already mentioned.

"As the orchard, if neglected, is almost certain to be in sod, the soil should be ploughed shallow in the spring, turning under a good dressing of manure if it can be procured. If the sod is not too thick, it might be worked up with the disc or spade harrow. The ground should then be kept thoroughly harrowed until July, working in other fertilisers if the land be poor and manure is not to be had; and then red clover seed sown at the rate of twelve pounds per acre, and the ground rolled. A good clover crop should then be formed by autumn. This would conclude the first season's work. The result would, probably, be a greatly increased vigour in the trees, and the fruit, though perhaps not plentiful, would be cleaner.

"The second season, additional but less pruning should be done, the trees kept thoroughly sprayed as before, the clover ploughed under in the

spring, and the land kept harrowed or cultivated until July, and then seeded down to clover. The fruit should be better than the year before, but not until the third year should the trees be expected to bear heavily and the orchard to be in good condition."

#### VARIETIES RECOMMENDED.

A list of varieties recommended is contained in Bulletin No. 20, and a repetition here is, therefore, considered unnecessary.

Professor S. W. Fletcher, lately of the Washington Agricultural College, Pullman, and now of Cornell University, Ithaca, N. Y., in a pamphlet entitled "A Sketch of Fruit-growing in the Pacific North-West," concludes with the following remarks:—

#### "THE DISTINCTIVE FEATURES OF NORTH-WESTERN FRUIT-GROWING.

"It seems to me that there are five distinctive features of North-Western fruit-growing. Eastern fruit-growers may consider each of these with profit:

"(1.) It places emphasis on high culture. I believe that North-Western orchards are, as a rule, tilled better, pruned better, and sprayed more thoroughly than most of the orchards in the Atlantic States. There is a special reason for this. The markets for North-Western fruit-growers are mostly distant, not near by, as in the East. They have found by dear experience that it will pay to ship long distances only the best of fruit; and the best fruit can be grown only under the best culture. Poor fruit, or even medium grade fruit, will not pay the freight.

"(2.) It emphasises the importance of careful grading and tasty packing. When freight rates are 60 per cent. of the selling price, there is little use in shipping poorly packed fruit. North-Western fruit-growers have found that the way their fruit is graded and packed is fully as important as its quality. Hence they pay especial attention to securing neat packages, attractive labels, fancy wrapping paper, and aim to have absolute uniformity in the size and quality of the fruit in each package. Many of our Eastern fruit-growers are distressingly lax on this vital point of attractive, uniform and conscientious packing. North-Western fruit-growers pack well because it pays well to do so; Eastern fruit-growers can reap the same liberal reward if they choose.

"(3.) It emphasises sectional horticulture. The difference in horticultural methods between the various regions of the North-West is so marked that the fruit-grower very quickly recognises the impossibility of having uniformity in orchard practice. He learns to consider his own farm as unique, and tries to work out a system of his own. To a greater or less extent this is true of every fruit-growing region. There is special need that the fact of the individuality of farms be more generally recognised in the East as well as in the West.

"(4.) It is reaching out for the markets of the world. North-Western fruit-growers are selling their fine Italian prunes in Europe right under the noses of unwilling Frenchmen, who have prunes of their own to sell. They are shipping apples to Hamburg and to Hong Kong. They are bidding for the fruit trade of the 400 million Chinese, the 40 million Japanese, and the

11 million Philipinos. This broad outlook on the markets of the world is one of the most striking features of North-Western fruit-growing.

"(5.) It is full of enthusiasm and aggressiveness. The special difficulties and uncertainties in marketing their fruit have made North-Western fruit-growers keen business men as well as skilful cultivators. Lack of business acumen in marketing is fully as often responsible for unsuccessful fruit-growing as lack of skill in culture. The horticultural meetings of the North-West are full of snap and vim; every man seems to have a lot of questions which he wants answered right away. The eagerness of these men to learn, to find a better way than the old, is very apparent.

"Generally speaking, this broad outlook, this aggressiveness, and constant reaching out for the new, are the most striking features of North-Western fruit-growing. Certainly these are the things which make the deepest impression on one who has received most of his horticultural training in the more conservative East. Eastern fruit-growers have their own special difficulties. They have merits as well as shortcomings which Western fruit-growers have not. Perhaps it is not fair to compare the two classes. It is no captious or critical spirit which leads me to wish that our Atlantic Coast fruit-growers might catch a little more of the enthusiasm, the aggressiveness and the open mind which characterises the fruit-growers of the Pacific North-West. It is but the unbiased comment of one who has observed both, and who believes that each can learn from the other."

J. R. ANDERSON,

*Deputy Minister of Agriculture.*

*Department of Agriculture,*

*Victoria, B. C., June, 1907.*

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